and loops), and might have been expected to be at the conference on those which was happening in Prague at the same time. But he came to Lisbon and told us about a very interesting cross-fertilisation between semigroups and loops. Just as a loop has a multiplication group, so Michael's more general structures (which he called "semi-loops") have a multiplication semigroup.

It was also very interesting to see that even people who work at the most theoretical end of group theory are turning to computation in their research, to make and test conjectures and even to help prove theorems. This is a trend which will continue!

You are a traveler; would you like to tell us about a special trip/episode?

There are so many stories I could tell, and some of the best are possibly embarrassing or dangerous to tell. Mathematicians form a universal fellowship, and wherever I go, even in places with authoritarian regimes, the mathematicians treat me like one of them, and I see the place from the inside. Seeing places as different as Iran and Japan from the inside is an amazing experience: skimming stones on the Caspian Sea at sunset as the night fishermen were setting out, and the tea ceremony in Tokyo escorted by the partner of a colleague.

One thing that remains with me happened on my visit to India in 1988. I was staying at the University of Bombay, and they arranged for me to make a visit to Poona to give a talk. I went up and back by train. While I was there, the algebraist Devadatta Kulkarni took me round the city on the back of his scooter. One of the days of my visit happened to be Christmas Day, but it was a busy day at the mathematics department, since a big conference was beginning the next day. So, two students were given the job of looking after me and taking me round the town, to temples, markets, and so on. I found out on talking to them that, as well as studying for their PhDs, they were both teachers at the local high school, doing something like 20 contact hours a week! I tried to repay my debt to them by talking about mathematics, going through a paper they were reading and helping them with some of their difficulties.

I keep travel diaries on many of my trips, and put them on my web page if they are not too scurrilous! The story of my Indian trip, and a later trip to India, are both there. http://www.maths.qmul.ac.uk/~pjc/travel/

Along the years, you have been seriously interested in sport, music, literature, painting, which are your hobbies nowadays?

Sport was probably my most serious interest — I was Australian Universities champion at cross-country running when I was a student — but, as I get older, I find that injuries take longer to heal, so I do more walking than running now. I try to go for a long walk at least once a week (anything from 15 to 50 kilometres). London is a good city for walking, since the transport system is centralized, so it is easy to escape in any direction. Also, I have rediscovered photography. Digital compact cameras now are probably as good as the SLR I had when I was a student, and I am building up a good collection of photographs of places where I walk.

I play the guitar (I learned this at university where I played in a band). Since I play by ear, I am not restricted in what I can play. The guitar is a good barometer of my stress levels; if I go for months without picking it up, I am in a bad way! London is also a good city for music since every great musician (like every great mathematician) comes to visit.

I didn't read much at school, but discovered literature at university, and now I am an avid reader; maybe I am addicted to print.

An e-reader fan or do you prefer the "real thing", the paper book?

For me, a real book is better. Maybe you like what you grow up with! When I first had an e-reader, I tried using it for keeping slides of my talks, so I would know what was coming next; but I found I was never using it. The advantage of an e-reader is that you can get classics free or very cheaply. I am currently reading Gibbon's "Decline and Fall of the Roman Empire".

I would say that you are a free spirit; would that have its deep roots in your upbringing in Australia?

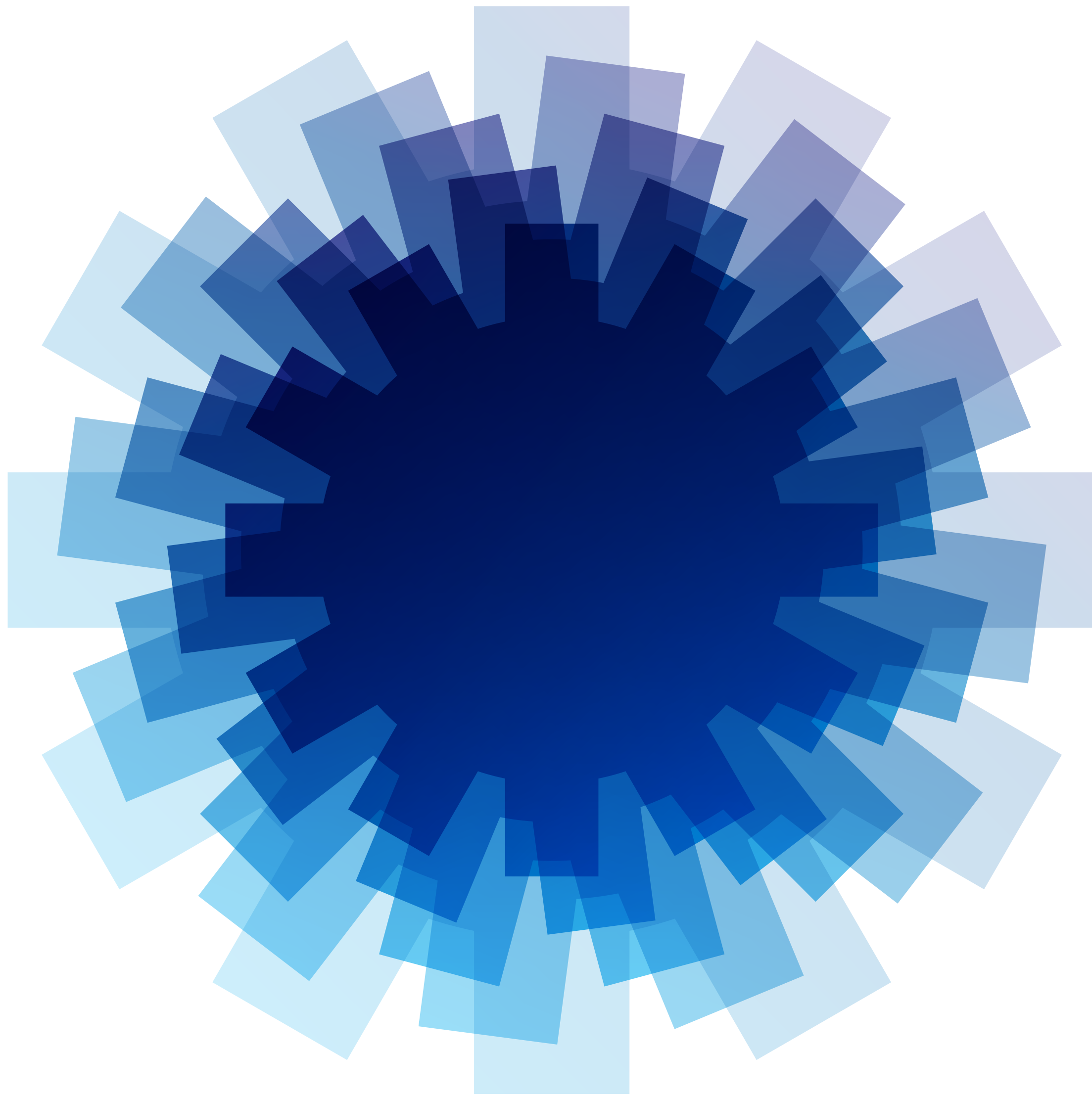
A hard question. Australians are, in fact, very conventional people. We introduced the term "tall poppy", meaning someone who is better than others at something and has to be cut down to size. I suppose this means that I learned to do what I wanted to do without making a song and dance about it. But it was also true that, growing up in the country, I learned that if nobody else could be found to do something, I could always simply do it myself. Travelling to the other side of the world to study and making a new life there must also have helped make me more independent.

Thank you Peter, it was a pleasure to interview you.

Lisboa, April 18, 2012

The 86th European Study Group with Industry

by Manuel B. Cruz [LEMA, Laboratory of Engineering Mathematics, School of Engineering of Porto's Polytechnic]



7 - 11 May, 2012
ISEP - School of Engineering | Polytechnic of Porto

The 86th European Study Group with Industry took place from May 7 to May 11, 2012 at ISEP, the School of Engineering of Porto's Polytechnic, organized by the Laboratory of Engineering Mathematics (LEMA) (*see*: http://www.lema.isep.ipp.pt/esgi86/). This meeting has counted with the participation of several experts with a large experience in this type of events. By the 5th consecutive year, Portuguese researchers and academics tried to strength the links between Mathematics and Industry by using Mathematics to tackle industrial problems that were proposed by industrial partners (*see*: http://www.ciul.ul.pt/~freitas/esgip.html).

In this edition there were selected 5 problems proposed by different companies namely, Neoturf (http://www.neoturf.pt/en), TAP Maintenance and Engineering (http://www.staralliance.com/en/ about/airlines/tap-Portugal_airlines/#), INESC (http://www2.inescporto.pt/ip-en/), Sonae Indústria – Produção e Comercialização de Derivados de Madeira, S.A and Euroresinas – Indústrias Quimicas Euroresinas, S.A., also a Sonae Group company (http://www.sonaeindustria.com/). For us, these problems were mathematically interesting challenges. For the companies, those were open-problems that had not been solved with their own (and/or consulting) resources, some of them for several years. This *bouquet* of problems was "multicharacteristic" in several ways. First of all due to different origin companies, second, due to the "multi-scope" of the problems. And last, the multitude of mathematical subjects used during the event which comprehended statistics, classification, optimization, numerical analysis or partial differential equations, just to name a few.

In this year's Portuguese ESGI, the results overwhelmed the organizers (and the companies') best expectations. For the organizers, some of them involved since 2007 when the first Portuguese ESGI edition took place, the objective is to spread mathematical knowledge and use it to help the industrial tissue. According to them, the success of ESGI's in Portugal may be measured by the growing number of participants, proposed problems, and by the fact that some companies are submitting new problems after their first participation. The comments from the companies' representatives were very positive. Pedro Mena and Fernando Guimarães (Euroresinas representatives), told at the end of the Study Group: "ESGI'86 was the first Sonae Industria participation on ESGI events. This format and analysis is, as such, newer to the company and is being addressed with great expectation and curiosity. After this initial experience, we consider of great significance this Mathematics-Industry partnership in the approach of subjects with most relevance to the national industry."

Telmo Rodrigues, from Sonae Indústria, said in the last day: "This meeting was very important, as it allows us to understand some phenomena of processes that weren't perfectly characterized". Neoturf CEO, Paulo Palha, went a little bit further in a post-ESGI interview. In the context of the workshop when asked about if the workshop fulfilled Neoturf expectations, he stated: "Undoubtedly! It certainly exceeded our best expectations as the problem proposed was identified more than 10 years ago but remained unsolved since then. We had consulted several software companies, tried some of their proposals, but nothing got even closer to the result achieved by the ESGI study group." The organizers, as mathematicians who care about the relation between academia and industry, also asked him how this format could be improved. His answer enclosed an important clue: "I think it would be very important to spread extensively this event, as most of the Small and Medium Companies aren't aware of the huge arsenal of techniques and resources that mathematicians have to solve our problems. Another idea is to have workgroups that can be hired by industry."

Kinetic approach to reactive mixtures: theory, modelling and applications

by Ana Jacinta Soares*

Abstract.—Some recent studies arising in the kinetic theory of chemically reactive mixtures will be revisited here, with the aim of describing some methods and tools of the kinetic theory used to model reactive mixtures and investigate some mathematical and physical problems.

Keywords.—Mathematical modelling; Kinetic theory; Chemically reactive systems.

1. Introduction

The kinetic theory of gases is a branch of statistical mechanics which deals with non-equilibrium dilute gases, i.e. gas systems slightly removed from equilibrium. Instead of following the dynamics of each particle, the kinetic theory approach describes the evolution of the gas system in terms of certain statistical quantities, namely velocity distribution functions, which give information about the distribution of particles in the system as well as the distribution of particle's velocities. One of the main tasks is then to deduce the macroscopic properties of the gas system from the knowledge of the molecular dynamics in terms of the distribution functions and, at the same time, to derive governing equations for these macroscopic properties in the hydrodinamic limits.

Historically, the modern kinetic theory starts with the contributions from August Krönig (1822–1879), Rudolf Clausius (1822–1888), James Maxwell (1831–1879) and Ludwig Boltzmann (1844–1906) and the central result of this theory is attributed to the celebrated Boltzmann equation (BE), derived in 1872, see Ref. [1]. This is an integro-differential equation that describes the evolution of a gas as a system of particles (atoms or molecules) interacting through brief collisions in which momentum and kinetic energy of each particle are modified but the states of intramolecular excitation are not affected.

The Boltzmann equation arises in the description of a wide range of physical problems in Fluid Mechanics, Aerospace Engineering, Plasma Physics, Neutron Transport as well as other problems where chemical reactions, relativistic or quantum effects are relevant. From the mathematical point of view, the Boltzmann equation presents several difficulties, mainly associated to the integral form of the collisional term describing the molecular interactions. In particular a general method for solving the Boltzmann equation does not exist, and only equilibrium (exact) solutions are know. Thus the mathematical analysis of the Boltzmann equation, in particular the properties of the collisonal terms, existence theory and approximate methods of solutions, constitute an interesting research topic in Mathematical Physics.

Available techniques for solving the Boltzmann equation and its variants are based on the approximate methods proposed by David Hilbert (1862–1943) in 1912 and by Sidney Chapman (1888–1970) and David Enskog (1884–1947) around 1916–17. The Hilbert method is a formal tool that obtains approximate solutions of the Boltzmann equation in the form of a power series of a small parameter inversely proportional to the gas density (the Knudsen number). Enskog generalized the Hilbert's idea and introduced a systematic formalism for solving the Boltzmann equation by successive approximations, and Chapmann followed the method of Maxwell to determine the transport coefficients of diffusion, viscosity and thermal conductivity. The ideas of Enskog combined with the method of Chapman led to the so called

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